

概率图模型笔记

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1 概率图

Bayesian Network

$P(x_1, x_2, \dots, x_p) = P(x_1) \prod_{i=2}^p P(x_i | x_{pa(i)})$

条件独立性: $x_A \perp x_C | x_B$

因子分解: $P(x_1, x_2, \dots, x_p) = \prod_{i=1}^p P(x_i | x_{pa(i)})$

$x_{pa(i)}$ 是 x_i 的父节点集

head-to-tail: $a \rightarrow b \rightarrow c$, $a \perp c | b$

tail-to-tail: $a \rightarrow b \leftarrow c$, $a \perp c | b$

若 b 被观测, 路径被阻塞

默认情况: $a \perp c$, 即路径是阻塞的

若 b 被观测, 则路径连通

若 d 被观测, 则 $a \rightarrow c$ 路径连通

head-to-head: $a \rightarrow b \leftarrow c$, $a \perp c$

概率图

D-Separation

$x_A \perp x_C | x_B$

锅 Markov Property

$P(x_i | x_{-i}) = \frac{P(x_i, x_{-i})}{P(x_{-i})} = \frac{P(x)}{\int_{x_{-i}} P(x) dx_{-i}} = \frac{\prod_{j=1}^p P(x_j | x_{pa(j)})}{\int_{x_{-i}} \prod_{j=1}^p P(x_j | x_{pa(j)}) dx_{-i}}$

$P(x_i | x_{pa(i)}) = f(\bar{x})$

$P(x_{child(i)} | x_i, x_{parent(child(i))})$

Markov Blanket

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